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Investigation of Microplasma Instabilities at 1 GHz[1] CHEN WU, JEFFREY HOPWOOD, Tufts University — Microwave microplasmas have been operated stably in excess of 2000 hours using less than one watt of power. Plasmas at atmospheric pressure and high power density, however, are subject to ionization overheating instability followed by a destructive glow-to-arc transition. We describe steady-state atmospheric pressure microplasmas in non-flowing argon and air driven by up to 40 watts of microwave power. These discharges are supported by either a quarter-wave microstrip resonator or a microstrip transmission line. Models show that the resonator configuration rejects excess power and remains unconditionally stable. The transmission line, however, couples power efficiently to a plasma of ~100 Ω and produces a more intense discharge. Electrodes of copper, aluminum and lead-based solder are investigated on both polymer and alumina substrates. Copper and lead electrodes may be evaporated by a high power microdischarge as seen by optical emission. These conditions uniquely result in severe electrode damage. Microdischarges supported on polymer substrates show C_2, CN and CH emission but alumina substrates are unaffected by the microplasma. These results show that steady-state microwave discharges can be stable at very high power density provided that copper microelectrodes and ceramic substrates are employed.

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